LaTeX Typesetting, Slide Simplified
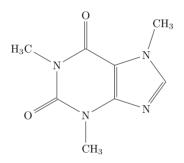
KL divergence

For distributions P and Q

$$\mathrm{KL}(P\|Q) = \int_{x \in \mathcal{X}} p(x) \ln \frac{p(x)}{q(x)} dx$$
$$= \mathbb{E}_{x \sim p(x)} \left[\ln p(x) - \ln q(x) \right]$$

What is Caffeine

Properties of Caffeine

Property	Value
Formula	$C_8H_{10}N_4O_2$
Molar mass	$194.194 \text{ g} \cdot \text{mol}^{-1}$
Density	1.23 g/cm^3
Melting point	235–238 °C

@ Video by Visual Laurence from Pixabay

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▌ Levenberg-Marquardt method

Objective

Minimize sum of squared residuals:
$$S(\mathbf{x}) = \sum_i [f_i(\mathbf{x})]^2 = \|\mathbf{f}(\mathbf{x})\|_2^2$$

Core Update Step

Solves for $\mathbf{h}_{lm}$ (the step):
$$(\mathbf{J}^\top \mathbf{J} + \lambda \mathbf{I})\mathbf{h}_{lm} = -\mathbf{J}^\top \mathbf{f}$$

$\mathbf{J}$: Jacobian matrix of $\mathbf{f}(\mathbf{x})$

λ: Damping parameter (non-negative)

Adaptive Damping

Small λ: Approaches Gauss-Newton method (faster)

Large λ: Approaches Gradient Descent method (more robust)

λ is adjusted based on iteration success

note: add \newcommand{\mbf}{\mathbf} to preamble

Algorithm: Levenberg-Marquardt method

$k := 0;\ \nu := 2;\ \mathbf{x} := \mathbf{x}_0$

$\mathbf{A} := \mathbf{J}(\mathbf{x})^\top \mathbf{J}(\mathbf{x});\ \mathbf{g} := \mathbf{J}(\mathbf{x})^\top \mathbf{f}(\mathbf{x})$

found $:= (\|\mathbf{g}\|_\infty \le \epsilon_1);\ \mu := \tau \times \max\{a_{ii}\}$

while (not found) **and** $(k < k_{\max})$ **do**

    $k := k + 1;$ Solve $(\mathbf{A} + \mu\mathbf{I})\mathbf{h}_{lm} = -\mathbf{g}$

    if $\|\mathbf{h}_{lm}\| \le \epsilon_2(\|\mathbf{x}\| + \epsilon_2)$ **then**

        found $:=$ **true**

    else

        $\mathbf{x}_{\text{new}} := \mathbf{x} + \mathbf{h}_{lm}$

        $\rho := (F(\mathbf{x}) - F(\mathbf{x}_{\text{new}}))/(L(\mathbf{0}) - L(\mathbf{h}_{lm}))$

        if $\rho > 0$ **then**   ▷ step acceptable

            $\mathbf{x} := \mathbf{x}_{\text{new}}$

            $\mathbf{A} := \mathbf{J}(\mathbf{x})^\top \mathbf{J}(\mathbf{x});\ \mathbf{g} := \mathbf{J}(\mathbf{x})^\top \mathbf{f}(\mathbf{x})$

            found $:= (\|\mathbf{g}\|_\infty \le \epsilon_1)$

            $\mu := \mu \times \max\{\frac{1}{3}, 1 - (2\rho - 1)^3\};\ \nu := 2$

        else

            $\mu := \mu \times \nu;\ \nu := 2 \times \nu$

        end if

    end if

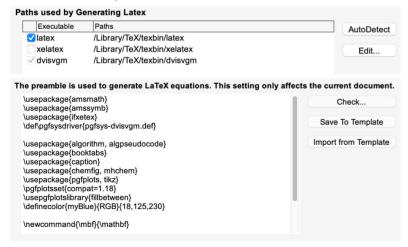**end while**

$\LaTeX$ Typesetting, Slide Simplified

▌ Getting Started

1. Install $\LaTeX$

Tex Live, MiKTex, MacTex, etc

2. Set path and preamble in TexSlide

Files → Options → Formula

Paths used by Generating Latex

Executable	Paths	
☑ latex	/Library/TeX/texbin/latex	AutoDetect
☐ xelatex	/Library/TeX/texbin/xelatex	Edit...
✓ dvisvgm	/Library/TeX/texbin/dvisvgm	

The preamble is used to generate LaTeX equations. This setting only affects the current document.

```
\usepackage{amsmath}
\usepackage{amssymb}
\usepackage{ifxetex}
\def\pgfsysdriver{pgfsys-dvisvgm.def}

\usepackage{algorithm, algpseudocode}
\usepackage{booktabs}
\usepackage{caption}
\usepackage{chemfig, mhchem}
\usepackage{pgfplots, tikz}
\pgfplotsset{compat=1.18}
\usepgfplotslibrary{fillbetween}
\definecolor{myBlue}{RGB}{18,125,230}

\newcommand{\mbf}{\mathbf}
```

Check...
Save To Template
Import from Template

3. Insert formulas

- TextBox: use $...$ or \(...\) to typeset math in inline mode
- Toggle between equation and text mode
- Insert Latex: create equation, table, TikZ and so on

The Taylor series of a real function $f(x)$, that is infinitely differentiable at a real a, is the power series
$\displaystyle{f(a)+{\frac {f'(a)}{1!}}(x-a)+{\frac {f''(a)}{2!}}(x-a)^{2}+ \cdots =\sum _{n=0}^{\infty }{\frac {f^{(n)}(a)}{n!}}(x-a)^{n}}$

↓ $\LaTeX$ + dvisvgm + 𝒥 TexSlide

The Taylor series of a real function $f(x)$, that is infinitely differentiable at a real a, is the power series

$$f(a) + \frac{f'(a)}{1!}(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \cdots = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!}(x-a)^n$$